**P48**

# Study of structure of a surface of a break of ceramics on the basis of SiC-AlN

G.D. Kardashova, Sh.Sh. Shabanov, G.K. Safaraliev

*Dagestan State University, Makhachkala, 367000 Dagestan Rep., Russia*
*gulya-ka11@yandex.ru*

The article is devoted to the establishment of technological aspects of the formation of composite ceramics based on silicon carbide and aluminum nitride by the method of hot pressing and to a research of structure of samples by methods AFM and by scanning electron microscopy (SEM).

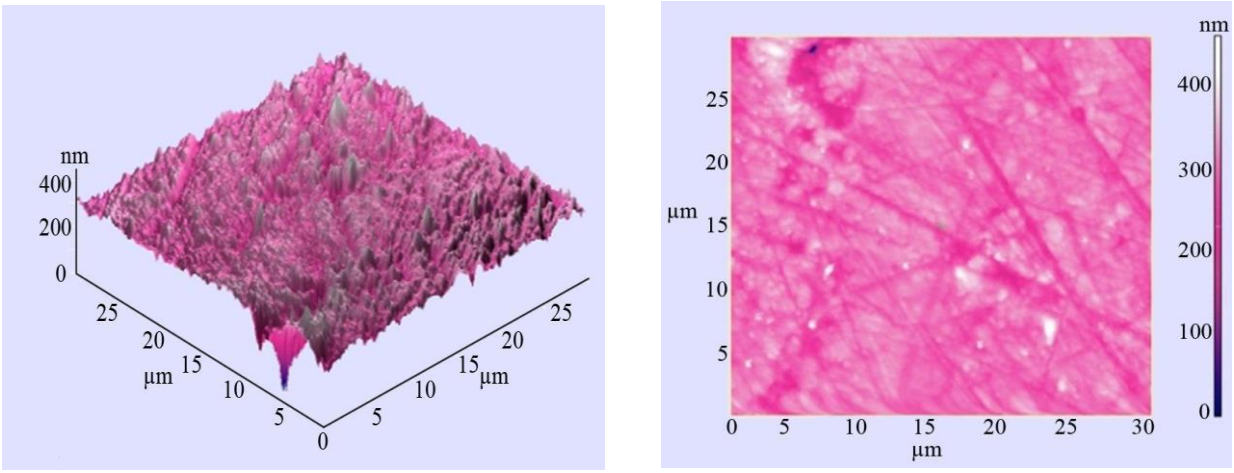
Problems of new functional and constructional materials formation on the basis of silicon carbide and aluminum nitride with predictable behavior make important the properties investigation. SiC-aluminum nitride (AlN) compositions are of great interest as perspective material for high-temperature devises.

Using of highly dispersed and active powders obtained by plasmochemical synthesis is especially is good for obtaining of fracture strength materials by hot-pressing. Dense fine-grained matrices are formatted with elongated grains of aluminum nitride and refractory grain boundary by use of such powders during hot-pressing.

The study shows structural features of SiC-AlN ceramic and its structurization and phase formation. The paper presents the results of the study of the microstructure of ceramics based on silicon carbide, obtained by hot pressing at temperatures up to 2170 K and pressures up to 35 MPa, of various compositions (0.9SiC - 0.1AlN; 0.7SiC - 0.3AlN; 0.5SiC - 0.5AlN; 0.3SiC - 0.7AlN; 0.1SiC - 0.9AlN), the average density of which is 3.21 g/cm$^3$ [1].

The structure of a surface of ceramics was investigated after preliminary grinding by diamond pastes and polishings. Scanning of a surface was carried out on an atomic force microscope (AFM). The semi-contact method was used, scanning was carried out by the probe sensor for semi-contact techniques.

Results of scanning showed that the grain size in ceramics on to silicon carbide basis with additive of 10% weight. AlN makes 10-20mkm. With increase in maintenance of AlN the size of grains decreases (Fig. 1) that is caused by the fact that nitride of aluminum interferes silicon carbide recrystallizations.



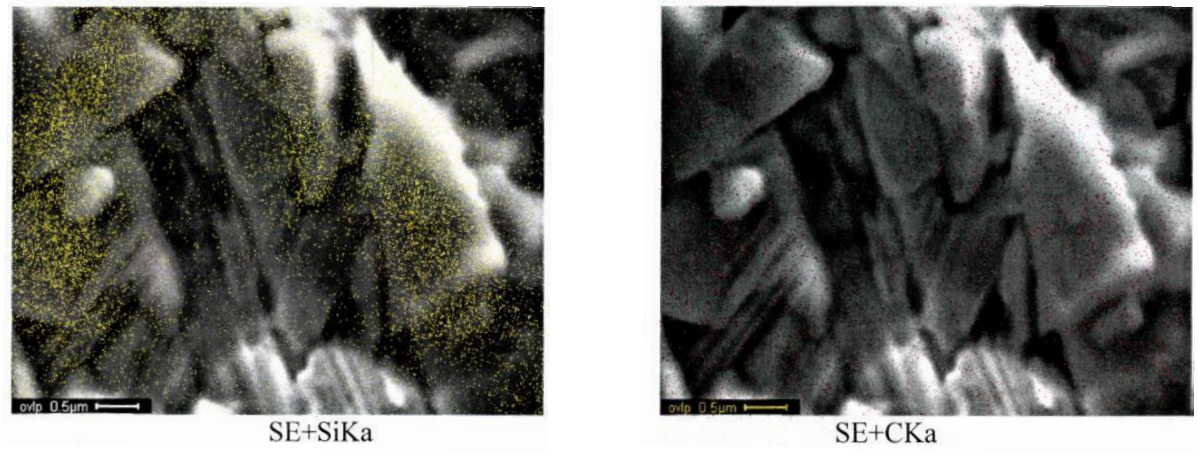

(a) (b)

Figure 1. Photos of a surface of a break of a sample of ceramics on the basis of SiC-AlN (30% SiC – 70% AlN): (a) surface relief in volume (b) surface relief on the plane.

Qualitative chemical analysis of SiC-AlN for Si, Al, N, C element was made by scanning electron microscopy (SEM) at detection resolution 127 eV. Experiment carried out by the most bright Kα spectra. This method require the prior etching of section and therefore the sample was etched in KOH at 750 K for 20 minutes with periodical mixing in order to remove faulted seam. It allowed getting whole etching of faulted surface material and obtaining nearly unruffled surface, which is preferable for local micro X-ray spectrum analysis.

Of special interest is phase formation in hot-pressed silicon carbide. The structure and composition of SiC ceramics is affected by various media and sintering temperatures, as well as the proportion of the content of mineralizers and modifiers.

The results of phase analysis of the SiC-AlN ceramic sample (70% weight of SiC) are given below. Using the SEM compositional contrast ratio method, it is possible to identify phases, grain rims and to determine the nature of the distribution of elements over the grain section, the chemical composition of various inclusions. The observed grain contrast ratio is used to detect various dispersed phases. As a result of the studies, photographs of the morphology of the sample with the distribution of phases throughout the sample were obtained.




(a) (b)

Figure 2. Results of the phase analysis of ceramics SiC-AlN (30% weight AlN): (a) distribution of a phase Si; (b) distribution of a phase C.

Obtained results allow to establish the features of synthesis of composite ceramic on the basis of silicon carbide and aluminum nitride and to optimize this formation technology.

1. Kardashova G.D. *Sintering processes and electrophysical properties of ceramics based on silicon carbide with activating additives* (Makhachkala: PhD dissertation) (2004).